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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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TORREY BOTANICAL CLUB

FEBRUARY, 1923

Notes on Rosaceae—XIV

PER AXEL RYDBERG

ROSES OF THE PRAIRIES AND PLAINS

The area here treated comprises the states between the Mississippi River and the Rockies and north of Oklahoma, with the exception of Missouri, in which so many southern plants are found and in which the Ozark Mountains have a different flora from the plains. As a key to the groups has already been published in a preceding paper,* I shall here omit the same, and I shall omit also the general discussion of any species already treated there, only citing specimens collected in the region now under consideration.

I. SYNSTYLAE

Leaflets glabrous or slightly pubescent on the veins beneath, dark green and shiny above. 1. *R. setigera.*

Leaflets velutinous-pubescent beneath, rather dull above. 2. *R. rubifolia.*

1. ROSA SETIGERA Michx.

KANSAS: Cherokee County, 1896, *Hitchcock 676.*

2. ROSA RUBIFOLIA R. Br.

KANSAS: Manhattan, 1892, *Clothier.*

II. CANINAE

3. ROSA RUBIGINOSA L.

KANSAS: Riley County, 1896, *J. B. Norton 677*; 1897, *Clothier 1107.*

*See Bull. Torrey Club 45: 45-66. 1920.

[The BULLETIN for January (50: 1-60. *pl. 1*) was issued February 7, 1923.]

III. CAROLINAE

Leaflets not subcoriaceous.
- Infrastipular prickles decidedly curved, short, stout. 4. *R. palustris.*
- Infrastipular prickles straight (rarely slightly curved), slender.
  - Leaflets decidedly pubescent beneath. 5. *R. Lyoni.*
  - Leaflets glabrous or pubescent only on the veins beneath.
    - Leaflets not glandular-dentate, the teeth usually simple. 6. *R. carolina.*
    - Leaflets glandular-dentate, often with double teeth. 7. *R. serrulata.*

Leaflets subcoriaceous, densely pubescent beneath. 8. *R. rudiuscula.*

4. ROSA PALUSTRIS Marsh.

This has been reported only in the Mississippi and Minnesota River valleys, where the more pubescent western form has been found.

5. ROSA LYONI Pursh

KANSAS: Cherokee County, *Hitchcock 978.*
IOWA: Iowa City, 1916, *Wylie.*
Also reported from Minnesota.

6. ROSA CAROLINA L.

This has been reported from Minnesota and Kansas, but no specimens have been seen. It is found also in Wisconsin and Missouri.

7. ROSA SERRULATA Raf.

This has been reported from Iowa, but no specimens are now at hand.

8. ROSA RUDIUSCULA Greene

This belongs to the *Carolina* and not to the *Cinnamomea* group, having the hypanthium bristly and with the achenes inserted in the bottom only. The infrastipular prickles are small and scarcely stronger than the bristles. It also has spreading and deciduous sepals; and the leaflets are thicker and firmer than in *R. carolina* and *R. Lyoni.* The flowers are usually corymbose and the plant has the general aspect of *R. suffulta.* Dr. Greene in the original publications cited several specimens that do not belong to the species.

MISSOURI: Vale, 1906, *Bush 3916;* Little Blue, *Bush 208* (TYPE); Dodson, Jackson County, *Bush 160;* railroad north of Morley, 1893, *Eggert*; Grain Valley, *6998*.

IOWA: Amaxa, 1909, *M. P. Somes 3825*.

INDIANA: White County, southeast of Wolcott, *Deam 32712;* Laporte County, *32395*.

IV. CINNAMOMIAE

Infrastipular prickles wanting; branches unarmed or bristly, not prickly.

Inflorescence corymbose, terminating the stem (or rarely the branches); plant mostly suffruticose; stem very bristly, usually dying back to the ground (except in *R. polyanthema* and *R. Bushii*); leaflets 9–11.

Leaves glabrous or nearly so.

Leaflets obovate, pale and glaucous on both sides. 9. *R. subglauca.*

Leaflets elliptic or oval, dark-green above.

Leaflets mostly 2–5 cm. long, not glaucous beneath, acute at the apex; plant 3 dm. high or more; flowers several. 10. *R. arkansana.*

Leaflets rarely more than 2 cm. long, mostly rounded at the apex, somewhat glaucous beneath; plant 1–2 dm. high; flowers 1–3. 11. *R. Lunellii.*

Leaflets densely pubescent, especially beneath.

Plant 3–6 dm. high, usually dying back to the ground.

Sepal erect in fruit; plant not glaucous.

Upper stipules and bracts not densely glandular; leaflets 1.5–4 cm. long; plant 3–5 dm. high. 12. *R. suffulta.*

Upper stipules and bracts densely glandular; leaflets seldom more than 1.5 cm. long; plant 1–3 dm. high. 13. *R. alcea.*

Sepals reflexed in fruit; plant glaucous. 14. *R. conjuncta.*

Plant shrubby, not dying back; branches from the upper axils soon overtopping the inflorescence. 15. *R. polyanthema.*

Inflorescence of few, either solitary or corymbose, flowers ending lateral branches; plant shrubby leaflets; 5–7 (or rarely 9 on the shoots).

Stem densely bristly even in age; stipules, petioles, and rachis often glandular-granuliferous; flowers solitary.
Hypanthium decidedly pear-shaped or elliptic, acute at the base, with a distinct neck at the top.
Leaflets conspicuously glandular-granuliferous, but scarcely at all hairy beneath, rounded-oval, often double-toothed. 16. *R. Engelmanni.*
Leaflets densely pubescent only rarely slightly glandular beneath, mostly elliptic, simple-toothed. 17. *R. acicularis.*
Hypanthium subglobose, almost without a neck; leaflets glandular-granuliferous as well as pubescent beneath. 18. *R. Bourgeauiana.*
Stem unarmed or when young slightly covered with more or less deciduous prickles; flowers solitary or few.
Leaflets decidedly and finely pubescent beneath. 19. *R. blanda.*
Leaflets glabrous on both sides, glossy. 20. *R. subblanda.*
Infrastipular prickles present.
Hypanthium globose; neck usually obsolete.
Stipules, petiole, and rachis copiously glandular; leaflets often double-toothed with gland-tipped teeth. 21. *R. Fendleri.*
Stipules, petiole, and rachis not conspicuously glandular, the first ones sometimes slightly gland-toothed.
Leaflets glabrous or nearly so. 22. *R. Woodsii.*
Leaflets finely puberulent beneath.
Young shoots armed with stout flat prickles; fruit about 15 mm. broad. 23. *R. terrens.*
Young shoots merely bristly; fruit rarely more than 10 mm. broad. 24. *R. Macounii.*
Hypanthium elongate, pyriform or elliptic, with a distinct neck. 25. *R. pyrifera.*

9. ROSA SUBGLAUCA Rydberg

This is related to *R. arkansana* Porter and *R. suffulta* Greene; from the former it differs in the decidedly obovate leaflets, rounded at the apex and more coarsely toothed; from the latter in the glabrous leaves; and from both in the glaucous foliage.

SASKATCHEWAN: Six miles east of Battle River, August 15, 1906, *Macoun & Herriot 70942, 70943*; Breakmore, July 18, 1906, *70941*; Brandon, *12589*.

A specimen from Decatur County, Iowa, collected by T. J. and M. F. L. Fitzpatrick may also belong here.

10. ROSA ARKANSANA Porter

This species was described from the Arkansas Cañon near Cañon City. The type is a glabrous plant and so described. The more common *R. suffulta* of the plains is densely pubescent. This was mistaken for *R. arkansana* by Watson, who has been followed by most American botanists. *R. arkansana* is found in the prairie region as well, but is much more local. It seems to be confined to the river valleys, while *R. suffulta* prefers the prairies and plains. *R. Rydbergii* Greene is nothing but *R. arkansana*. The peculiar hue of the upper surface of the leaves, so much emphasized by Dr. Greene, is due to some disease, probably bacterial. Some of the leaves or some part of them have retained their natural color on the upper surface. Best regarded it as a variety of *R. blanda*.

MINNESOTA: Winona, 1882, *Hasse Herbarium*.
NORTH DAKOTA: Fargo, *Bolley 129, 130*.
KANSAS: Comance County, 1897, *Carleton 254*.

11. ROSA LUNELLII Greene

This is closely related to *R. arkansana* and perhaps only a depauperate form of the same. It is, however, a much smaller plant and more glaucous, and the leaflets are more rounded at the apex.

MANITOBA: Brandon, 1887, *Fowler;* 1898, *E. S. Thompson*.
NORTH DAKOTA: Leeds, 1907 and 1908, *Lunell*.
SOUTH DAKOTA: Hermosa, 1892, *Rydberg 678a*.
NEBRASKA: Long Pine, 1893, *W. R. Dudley*.

12. ROSA SUFFULTA Greene

The first record of this species is in Hooker's Flora Boreali-Americana, where Borrer referred it to a variety of *R. stricta*. Crépin made it a variety of *R. blanda* and Watson confused it with *R. arkansana*. Dr. Greene was the first to see that it was not *R. arkansana* and proposed the name *R. pratincola*, overlooking the fact that this name had been used before. Discovering this fact twelve years later, he substituted the name *R. heliophila*. C. K. Schneider discovered the same fact a year later, but not knowing of Greene's last name, proposed *R.*

arkansanoides. All these names are superfluous, however, for the plant is the same as *R. suffulta* Greene. Besides these names several varietal names have been proposed. *R. dulcissima* Lunell is apparently based on a more luxuriant and less bristly form of this species.

13. ROSA ALCEA Greene

This species stands somewhat in the same relationship to *R. suffulta* as *R. Lunellii* does to *R. arkansana*. The plant is described as having prickly hypanthium, but this is not always the case. The upper part of the plant, especially the upper stipules and the bracts, are densely glandular, the glands often extend to the pedicels and hypanthium, the stalks of the glands sometimes become indurate and hence the hypanthium is prickly in fruit. This is sometimes also the case in *R. suffulta*, which form was described as *R. pratincola setulosa* by Cockerell.

SASKATCHEWAN: Milk River Ridge, 1895, *Macoun 10541;* Moose Jaw, *Spreadboro 10625;* also *Macoun 10539;* Regina 1903, *Fowler;* Indian Head, *1;* Prince Albert, *Macoun 12767* (?).

SOUTH DAKOTA: Deadwood, *Carr 150*.

14. ROSA CONJUNCTA Rydberg

This is related to *R. suffulta* and *R. subglabra* on the one hand, and to *R. virginiana* on the other. It differs from the last in the lack of glandular hairs on the hypanthium; in the pale green leaves with sharper toothing; in the absence of infrastipular spines; and in the insertion of the achenes, which is on the inside walls as well as in the bottom of the hypanthium. From *R. subglauca* it differs in the leaves pubescent beneath and in the reflexed sepals. It resembles *R. suffulta* in habit and pubescence, but the leaflets are more acute at the apex and cuneate at the base and glaucous, and the sepals are reflexed or spreading after anthesis. As the plant has been confused with *R. suffulta* and *R. arkansana*, this latter character caused the error in Britton's Manual, in which *R. arkansana* (which then included *R. suffulta*) was described as having spreading sepals. I am responsible for the error. *R. conjuncta* might be a hybrid of *R. suffulta* and *R. Lyoni* or some other species of the *Carolina* group, but none of the species of that group or of the *Cinnamomea* group (except the high northern *R. subglauca*) has

the glaucous foliage of *R. conjuncta*. Hence it must be regarded as a distinct species.

15. ROSA POLYANTHEMA Lunell

This species resembles *R. suffulta* in the leaf-form and inflorescence, but the plant is shrubby, the upper branches soon overtopping the inflorescence. It is known only from the type locality and vicinity.

16. ROSA ENGELMANNI S. Wats.

In describing this species Dr. Watson included some eastern specimens which belong to *R. acicularis*. This has caused much confusion. Some botanists have regarded *R. Engelmanni* as a variety of *R. acicularis*, some as a mere synonym. *R. Engelmanni* is a purely Rocky Mountain species. The most eastern station from which the writer has seen the same is in the Black Hills of South Dakota. The specimens referred to it from Minnesota, Michigan and northern New York belong to *R. acicularis*. In *R. Engelmanni* the leaflets are much more rounded, without pubescence, but distinctly glandular-granuliferous beneath, usually double-toothed and with gland-tipped teeth. In *R. acicularis* on the contrary the leaflets are inclined to be elliptic, conspicuously pubescent but scarcely glandular beneath and with simple teeth.

Most of the specimens seen of *R. Engelmanni* are from Colorado and a few are from southern Wyoming. The only specimens from the region here treated are the following, but even these are not from the prairies and plains but from the mountains or wooded hills.

SOUTH DAKOTA: Spearfish Cañon, Black Hills, *Murdock 4136*; Rochford, *Rydberg 676* (in part); Custer, *Rydberg 676* (in part).

17. ROSA ACICULARIS Lindl.

Within the region the species is found only in the northern wooded part. Among other specimens may be mentioned:

MINNESOTA: Sandy Lake, *Sandberg 793*.

18. ROSA BOURGEAUIANA Crépin

Within the region it is found only in the northeastern wooded region.

MINNESOTA: Duluth, *Rydberg 8004*; St. Louis River, Carlton County, *Sandberg 130;* Two Harbors, *E. P. Sheldon.*

19. ROSA BLANDA Ait.

This species is confined within the region to the hardwood groves in the northern part. I can see no difference between the specimens from North Dakota, on which *R. gratiosa* Lunell was based, and those from the Eastern States.

MINNESOTA: Lake Minnetonka, *Sandberg, 798;* Thompson, Carlton County, *Sandberg 397;* Minneapolis, 1895, *E. P. Sheldon;* Lake Itasca, *G. B. Aiton.*

NORTH DAKOTA: near St. John, Rolette County, 1912, *Lunell* (*R. gratiosa*); Pleasant Lake, Benson County, 1912, *Lunell;* Turtle Mountains, 1912, *Lunell*; Bottineau, 1890, *Waldron.*

MANITOBA: Oak River, *Macoun & Herriot 70937;* six miles east of Forest, *Macoun & Herriot 70940.*

20. ROSA SUBBLANDA Rydberg

It is questionable if this species should be included among the prairie roses, as the following specimens are referred to it with considerable doubt.

IOWA: Grinell, 1877, *M. E. Jones.*

21. ROSA FENDLERI Crépin

This species is related to *R. Woodsii* and often confused with it. It is distinguished by the glandular stipules, petioles, and leaf-rachis. Watson distinguished it from *R. Woodsii* by the entire instead of lobed sepals. In both species they are either entire or lobed. *R. neomexiana, R. arizonica, R. puberulenta* and *R. granulifera* have been confused with it, but these all have curved prickles, while in *R. Fendleri* they are longer and more slender, straight or nearly so. *R. Fendleri* is a common species in the Rockies, ranging from Montana to northern Mexico. It extends eastward also into the plains and prairies and was redescribed from North Dakota by Lunell as *R. poetica.*

MINNESOTA: Montevideo, *Moyer 581.*

NORTH DAKOTA: Bismark, 1912, *Lunell.*

SOUTH DAKOTA: Hermosa, *Rydberg 677.*

NEBRASKA: McCalligan Cañon, Deuel County, *Rydberg 100.*

22. ROSA WOODSII Lindl.

This was published in 1820 in Lindley's Monograph. Five years later Lindley published an illustration in the Botanical Register of what he supposed to be the same, but evidently he was mistaken. In the Botanical Register (*pl. 976*) Lindley gave the following remarks:

> It was subsequently named and published by the writer of these remarks . . . but the specimens which were examined for the purpose, were so imperfect that, upon a comparison of the characters ascribed to the species with fresh specimens, they were ascertained to be materially erroneous; the stipulae, which were stated to possess the remarkable peculiarity of being convolute like those of *R. carolina*, proving to be, in fact, like those of *R. lucida*.
>
> But in M. de Candolle's Prodromus a new character is proposed for this plant. M. Seringe, by whom the article Rosa was prepared, had an opportunity of examining specimens in De Candolle's Herbarium. And yet our original error is still retained by Mr. Seringe, who has added to it more than one of his own. He defines the leaflets to be shining, while in fact they are the reverse; the sepals to be naked, which are covered with glands; and the lower pair of leaflets to be placed at a distance from the others, and fringed with glands, a peculiarity which we believe does not exist.
>
> We cannot dismiss this subject without expressing our regret that the general brilliancy of M. de Candolle's Prodromus should be tarnished by an article so inaccurately compiled as the genus Rosa is, in the 2d volume of that work.

These cutting remarks of Lindley's were wholly unwarranted, for Seringe did not assign any new characters that were not found in Lindley's original publication, and it was the latter himself that assigned new characters. Let us recite a few lines from Lindley's own description in his Monograph, page 22.

> *Leaves* without pubescence; stipules very narrow and acute, convolute and fringed with glands . . . *Leaflets* 7–9, shaped like those of *R. rubella*, shining, flat, simple, acute, paler beneath . . . *Fruit* naked, ovate, with short, connivent, entire *sepals* which are free from glands as is the peduncle.

From this it is evident that *Rosa Woodsii* of the Botanical Register is not the same as the original one described in Lindley's Monograph. This carelessness on Lindley's part has caused a great deal of confusion, and it is hard to know what the original *R. Woodsii* was. Some have suggested *R. humilis*, but as the pedicels, hypanthium and sepals were without glands and the latter connivent, this suggestion is far from the truth.

Others have suggested *R. blanda* Ait., but the true *R. blanda* is a boreal plant and not found on the Missouri, and the leaves are dull and pubescent beneath. The *R. Woodsii* of the Botanical Register might sooner be a form of that species. The only species that agrees with the description of the original *R. Woodsii* is the one that Torrey called *R. foliosa leicocarpa* and in my flora of Colorado I called *R. Macounii*, the same as Greene has described as *R. Sandbergii* and Lunell as *R. deserta*. I also think *R. fimbriatula* Greene belongs here. It is a shrub belonging to the Rocky Mountain region but extends eastward to the Missouri River. Watson referred it partly to *R. Woodsii*, partly to *R. Fendleri*. Watson assigned also new characters to *R. Woodsii*, viz. lobed sepals. Notice that Lindley originally described them as "entire." The lobing or not-lobing of the sepals is a character of no value in the *Cinnamomea* group. In other groups as for instance, the *Carolina* and *Canina* groups, it is a fairly reliable character. *Rosa Maximiiliani* Nees belongs to this species.

NORTH DAKOTA: Pleasant Lake, Benson County, 1912, *Lunell* (*R. deserta* Lunell); Little Missouri River, *Moyer 702*.

SOUTH DAKOTA: Missouri River, north of White River, *Hayden 254;* White River, *Stearns*.

NEBRASKA: Cheyenne County, *Rydberg 101*.

KANSAS: Rawlins County, *Hitchcock 978a*.

23. ROSA TERRENS Lunell

This species differs from all the species of the *Cinnamomiae* of eastern North America in the stout prickles especially on the shoots. The prickles are fully as stout as those of the sweet brier. It is only known from the type collection.

24. ROSA MACOUNII Greene

It has been shown that the pubescent plant illustrated by Lindley in the Botanical Register under the name *R. Woodsii* has had a very confused nomenclatorial history. Watson thought it was the original *R. Woodsii* and stated that it was the same as *R. Maximiliani* Nees. At the time when I noticed the discrepancy in Lindley's treatments, I thought that Watson's statement was correct and adopted the name *R. Maximiliani* for the present species. The name was used in that sense in my

Flora of Colorado. Later I have had access to Prince Maximilian's Reise and found that the plant described there was the glabrous plant or the true *R. Woodsii*. In my Flora of Colorado I made another mistake, adopting the name *R. Macounii* for the glabrous plant, depending upon the impression I had received from Greene's rather vague description. After having seen Greene's type, though this does not represent the common form of the species as I know it, I came to the conclusion that the name *R. Macounii* should be adopted for the species here treated, being the oldest available name. *R. grosseserrata* E. Nelson was a mixture, but the type evidently belongs to the large-leaved form of this species not uncommon in the Central Rockies. *R. subunda* Lunell represents a depauperate form and *R. naiadum* the more common form of the plains and prairie region.

MINNESOTA: Montevideo, *Moyer 372*.

NORTH DAKOTA: Kuhn, La Mouse County, *Brenckle;* Minot, Lake Ibsen, Jamestown, Tower, and Butte, *Lunell* (without numbers).

SOUTH DAKOTA: Hermosa and Hotsprings (Black Hills), *Rydberg 677;* Wolf Creek, *Visher 2189;* Bear Creek, *Visher 2032;* Mobridge, *Moyer 691*, Big Stone Lake, *542*

NEBRASKA: Chadron, *J. M. Bates;* Lawrence Fork, *Rydberg 102;* Banner County, *Rydberg 98;* Hay Springs, *MacDougal 102;* Nattick, Thomas County, *Rydberg 1848*.

25. ROSA PYRIFERA Rydberg

This is a species of the Northern Rocky Mountains, first mentioned by Watson in a note under *R. Fendleri*.* It differs in the pear-shaped fruit and the more numerous, rather corymbose flowers. A few rather dubious specimens have been collected in the plains and prairie region. These have fruits which are inclined to be ellipsoid, rather than pyriform. Among them may be noticed.

SOUTH DAKOTA: Mobridge, *Moyer 688*.

* Proc. Am. Acad. **20**: 345. 1885.

Sex reversal in the Japanese hop*

JOHN H. SCHAFFNER

(WITH PLATE 2)

After it became evident that abundant reversal of the sexual state takes place in *Cannabis sativa* L., when grown in the greenhouse during the short days of winter†, experiments were also made by the writer on *Humulus japonicus* Sieb. and Zucc., the Japanese hop. This hop is usually an annual, the vine growing from 10 to 30 feet long when planted in early May. It is a diecious plant much like the common hop, *Humulus Lupulus* L., but the carpellate catkins are not glandular. Both the inflorescence and the vegetative parts of the flowers show decided sexual dimorphism. The staminate inflorescence is a loose panicle and the staminate flower usually has three, four, or five distinct sepals with three, four, or five stamens and no vestige of a gynecium; while the carpellate inflorescence is an ament-like, large-bracted spike, and the carpellate flower has an entire sheath-like perianth surrounding the bicarpellate ovulary with no vestiges of stamens.

In recent years, both species of hop have been studied by Tournois‡ and by Winge.§ Both of these authors mention the occurrence of intermediate or monecious individuals in *Humulus*. Winge apparently obtained normal pollen from a monecious plant but does not state whether this plant was to be considered as staminate or carpellate. It is quite evident that in the hop, as in the hemp, the plants are originally determined as carpellate or staminate and the intermediate condition arises thru sex reversal during vegetative growth. Tournois reports 10 chromosomes in the gametophytes of both *H. Lupulus* and *H.*

---

* Papers from the Department of Botany, The Ohio State University, No. 135.

† Schaffner, John H. Influence of environment on sexual expression in hemp. Bot. Gaz. 71: 197–219. 1921.

‡ Études sur la sexualité du huoblon. Ann. Sci. Nat. Bot., 19: 49–191. 1914.

§ The pollination and fertilization processes in *Humulus lupulus* L. and *H. japonicus* Sieb. et. Zucc. Compt. Rend. Trav. Carlsberg 11: 1–44. 1914.

japonicus, but Winge is convinced that *H. Lupulus* has ten (haploid) and twenty (diploid) chromosomes and *H. japonicus* eight (haploid) and sixteen (diploid). He found no evidence of an allosome.

When Japanese hop is planted in the greenhouse in winter it becomes greatly dwarfed and the sexual state is much confused in a very large percentage of cases. Seed planted December 8th, 1920, in shallow benches produced twenty-two plants. They began to bloom in the sixth week after planting, some in exactly twenty-four days after coming out of the ground. The growth is considerably slower than in hemp under the same conditions. The plants usually have two or three pairs of leaves when they begin to bloom. Of the twenty-two plants raised in the winter of 1920–21, six were staminate and all showed reversal to the carpellate condition, i. e., they were staminate plants which produced carpellate structures from certain parts of their bodies. The carpellate structures appeared to be of all degrees of perfection. The remaining sixteen plants were carpellate and of these seven showed reversal to the male condition, producing staminate flowers or structures in various degrees of perfection, while nine remained pure carpellate and showed no sex reversal. Some of the carpellate intermediate individuals showed sex reversal at the beginning of blooming in the terminal inflorescence while others did not do so until a large number of typical carpellate inflorescences had been produced, and then only in axillary inflorescences developed at the base of the plant. One plant was especially remarkable in that it appeared to be pure carpellate in nature and had produced twelve normal carpellate inflorescences, when finally a tiny axillary cluster was developed near the base of the stem which showed one ovulary with a well-developed stamen at its base. No more staminate structures were found on this plant. Another decidedly carpellate plant developed thirty-six inflorescences and then produced a tiny cluster from near the base of the stem with several abnormal flowers. There were three stamens in the cluster. Other plants, both staminate and carpellate, produced numerous flowers or almost entire inflorescences of the opposite sexual state.

Although the staminate plants usually show sex reversal immediately, one plant remained pure in expression for a long

time but finally developed a lower branch with a mixed inflorescence, several flowers showing imperfect ovularies and a number of well-developed stigmas. It is evident then, that reversal of sex varies both in the extent of the tissues involved and in the intensity or perfection of the given state. A large carpellate plant may produce but one imperfect stamen during its entire ontogeny and a staminate plant may show no sex reversal except the development of a single stigma on the entire individual. At the other extreme both kinds of individuals may produce perfect structures of the opposite sex. Some individuals show such a decided bisporangiateness that they sometimes have nearly equal numbers of the two kinds of structures in various degrees of perfection.

In hemp the general tendency appears in age to be towards maleness in both staminate and carpellate plants, altho some individuals are exceptional in this respect; but such a tendency was not evident to any extent in the Japanese hop except in a few individuals. The important factor in causing the reversal of the sexual state in the winter plants seems to be the greatly shortened period of daily illumination, and from other experiments it is probable that reversal takes place more readily if the plants are at the same time growing in a very rich soil, largely made up of well-rotted cow manure.

The nine carpellate plants which showed no reversal remained in the greenhouse until May when they were showing a decided rejuvenation and were planted out of doors where they continued to be pure carpellate.

The same kind of sex reversal was obtained in the winter of 1921–22, but the press of other experiments prevented a detailed study. No less remarkable than the reversal of the sexual state shown by the winter plants are the decided shortening of the vegetative period before anthesis and the great reduction in the size of the plant body. One extreme staminate intermediate plant had two cotyledons and two pairs of leaves and then ended in a small terminal inflorescence. There were flower clusters also in the axils of the cotyledons and the four leaves.

The accompanying plate represents a series of flowers to show in a general way the progressive change of sexual expression and the confusion which sometimes occurs in the stamens and ovularies. The examples, however, do not by any means

represent the diversity of floral structure to be found. Such confusion in character expression is quite generally present whenever the change from one sexual condition to the other takes place on a developing monecious inflorescence axis or when two tissues of opposite sexual state meet at a point predestined by its position to give rise to a flower, as shown by the writer elsewhere.*

FIG. 1 represents a typical staminate flower from a staminate plant and FIGS. 2–12 represent a series of flowers and flower parts taken from staminate plants with sex reversal. They show how one can find all stages of transition and confusion in the sexual expression. Stamens may develop stigmas (FIGS. 2, 3, 6), ovularies may give rise to microsporangia (FIGS. 5, 9, 10, 11), and normal or nearly normal stamens and ovularies may develop in the same flower (FIG. 8).

FIG. 13 represents a typical carpellate flower from a carpellate plant, and FIGS. 14–22 represent a series of flowers from carpellate intermediate plants showing various types of sex mosaics up to the normal staminate flower in FIG. 22. Just as in the reversed flowers from the staminate plants there are here striking cases of sex tissue mosaics. FIGS. 14 and 15 represent ovularies with stamens developing from their sides. The ovulary in FIG. 15 has but one stigma. FIG. 17 represents an ovulary with two microsporangia near the top, and FIGS. 20 and 21 imperfect carpel-stamen complexes in decidedly staminate flowers.

As stated before, such examples could be extended indefinitely, each one showing some rather prominent example of peculiar sexual expression. The development of these complex sex mosaics is due to the disturbances brought about by the abnormal environmental conditions, probably largely through a disturbed metabolism, which causes one cell or cell complex to be thrown into the male state while the neighboring cells remain in the female state, or vice versa. It seems clear that the more recent notions in regard to sex will need to be revised and restated in agreement with actually ascertained experimental evidence. The notion that sexuality is primarily hereditary in nature and Mendelian will have to be abandoned. It clearly does not appear

* Reversal of the sexual state in certain types of monecious inflorescences. Ohio Jour. Sci. 21: 185–200. 1921.

to be a matter of nuclear and chromosome morphology. The next steps are perhaps now possible—to ascertain something of the real nature of sexuality and a more definite knowledge of sex control in favorable plants. It appears to the writer that this must, to some extent at least, lead into the fields of ionization in chemistry and electrons and electricity in physics; in other words the biological phenomena of sex are probably fundamentally physico-chemical and not morphological.

CONCLUSION

From the results of the experiments with *Humulus japonicus* and other plants, it is evident that dieciousness with its accompanying sexual dimorphism is not due to the absence in either the staminate or carpellate individual of a complete set of hereditary factors for the expression of all the sexual characters, both male and female; nor is the monosporangiateness of the normal individual due to the presence of a homozygous or heterozygous condition of any kind of hereditary sex determination whatsoever, which might be assumed to gain or lose dominance at the time of the reversal of the sexual state; for, as shown in the preceding discussion, all of the staminate plants changed to a greater or less extent to femaleness and nearly half of the carpellate plants showed reversal to maleness by simply subjecting them to an unusual environment.

Those who are seeking an explanation of sex in terms of homozygous and heterozygous conditions of the male and female individuals are following a delusion obtained from an incomplete knowledge of the phenomena of sexuality as exhibited in the plant kingdom; for it is evident that gametophytes are haploid organisms and so cannot have their factors or chromosomes in a yoked condition, yet males, females, and hermaphrodites, and reversals of the given sexual states occur side by side in homosporous plants, including liverworts, mosses, hornworts, ferns, lycopods, and horsetails. In heterosporous sporophytes, bisporangiate individuals including the monecious species are the rule, and the diecious species represent only specialized conditions in respect to the sexual state; so here also, although the organism is diploid, the dieciousness is not at all caused by homozygous and heterozygous factors or chromosomes which control the sexual state, since both individuals can be caused to change to the opposite

condition in the vegetative phase of development, both naturally and through experimental means, the male to the female and the female to the male.

The sexuality of cells, tissues, organs, and individuals is due to some state or condition, apparently related to chemico-electrical phenomena, which arises in the cell units at certain stages of the ontogeny and gives a peculiar character, either male, female, or neutral, to the materials and structures produced through the operation of the hereditary factors present. It is probable that the identical factors may give rise to characters which we recognize as male or female; at least both kinds of structures arise in the same organs or tissues, side by side, which would under the usual expression be purely male or purely female.

COLUMBUS, OHIO

Explanation of plate 2

All the figures are slightly magnified.

FIG. 1. Staminate flower from staminate plant.

FIG. 2. Confused flower from staminate plant.

FIG. 3. From staminate plant. A central staminate structure with a stigma, the upper part of the stigma is destitute of stigmatic hairs. This flower had four normal stamens and five sepals.

FIG. 4. Flower from lower branch of decidedly staminate plant, showing imperfect ovulary with one stigma.

FIG. 5. Central ovulary with one stigma and an imperfect anther with two microsporangia growing out of the side near the top. The flower had four sepals and five normal stamens. Staminate plant.

FIG. 6. Flower from staminate plant with two stamens without stigmas but one with an ovulary-like outgrowth at the base, and with a central stamen-carpel complex.

FIG. 7. Flower from a staminate plant with three sepals, three stamens, and a central imperfect ovulary with one long and one short stigma.

FIG. 8. Flower from staminate plant, with one nearly perfect gynecum and one stamen.

FIG. 9. Confused carpellate flower from a staminate plant, the ovulary with three stigmas, the smaller one having a microsporangium at its base.

FIG. 10. An ovulary-like structure ending in a stigma and with microsporangia on opposite sides. From staminate plant.

FIG. 11. An ovulary with one prominent stigma and with a stamen growing out from its side. From staminate plant.

FIG. 12. A nearly perfect carpellate flower from a staminate plant. The perianth sheath is split down on one side instead of being continuous.

FIG. 13. A typical carpellate flower from a carpellate plant.

FIG. 14. Carpellate flower from carpellate plant, with a stamen growing out from near the base of the ovulary.

FIG. 15. An ovulary with one stigma and one stamen from near the base, from carpellate plant.

FIG. 16. A flower from a carpellate plant showing a stamen with a slight development of a stigma and a stamen-like ovulary with two stigmas.

FIG. 17. A carpellate flower from a carpellate plant, the ovulary with two abnormal stigmas and with two microsporangia near the top.

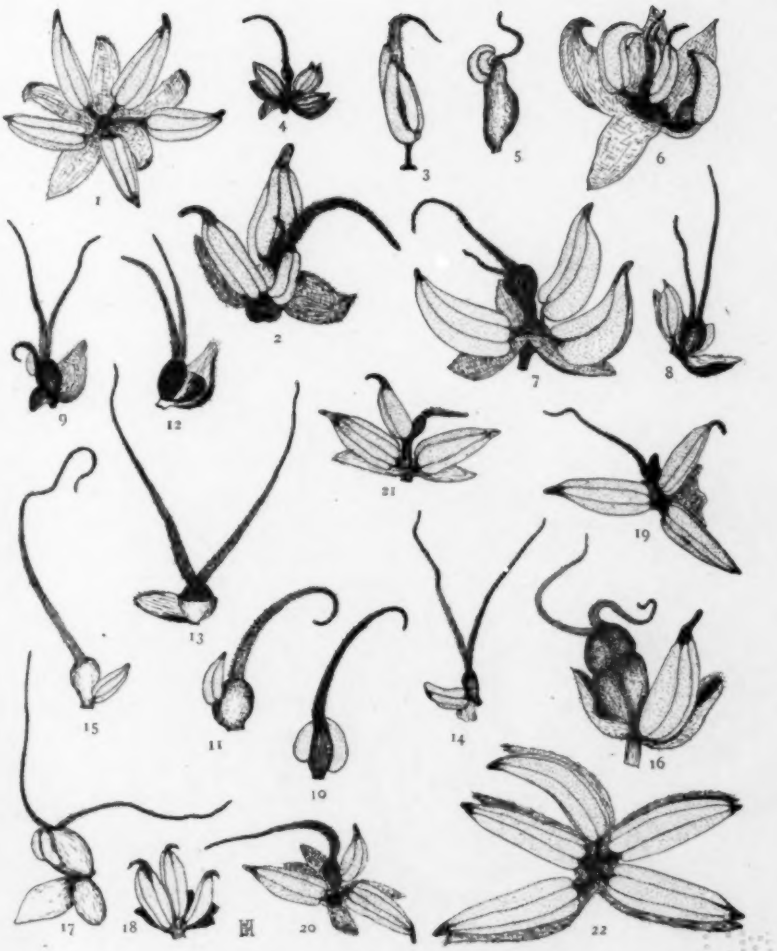
FIG. 18. A staminate flower from a carpellate plant. Each of the three stamens showing a rudimentary stigma. The perianth, a continuous, toothed structure, is cut open to expose the stamens properly.

FIG. 19. Flower from a carpellate plant, with three stamens, one growing from the side of the imperfectly developed ovulary showing a small stigma.

FIG. 20. Flower from a carpellate plant, with 4 sepals, two stamens and an imperfect ovulary with a stamen developed at its side and one stigma at the tip.

FIG. 21. A flower from a carpellate plant, showing two stamens and a central stamen-carpel complex.

FIG. 22. A perfect staminate flower from a carpellate plant.



SCHAFFNER: SEX REVERSAL IN JAPANESE HOP

What is Geranium caespitosum James?

GEO. E. OSTERHOUT

From the time when *Geranium caespitosum* was first published in 1825, when geraniums were few, till the present time, when they are many, there has been an uncertainty as to what species should have the name.

On July 6, 1820, at about noon, the Long Expedition, of which Dr. Edwin P. James was botanist, surgeon and geologist, and of which he became historian, went into camp on the bank of the South Platte, where it issues from the mountains. This is about fifteen miles from Denver, Colorado. Dr. James notes in considerable detail the rock formations about the camp. "The woodless plain," he says, "is terminated by a range of naked and almost perpendicular rocks, visible at a distance of several miles, and resembling a vast wall, parallel to the base of the mountains. These rocks are sandstone . . . About the sandstone ledges we collected a geranium intermediate between the cranes-bill and the herb-robert." I quote from the London edition of Dr. James's "Account" of the Expedition, which was published in 1823. At the end of Vol. 11, among the appended notes, is the following description of the *Geranium*: "Geranium intermedium, I.—Caespitose, sub-erect, pubescent, sparingly branched above. Radical leaves reinform deeply $\frac{5}{9}$ cleft. The flower is a little larger than that of G. robertianum, and similarly coloured, having whitish lines toward the base of the corolla." There is only one *Geranium* mentioned. It may be noticed that the description is short and so indefinite that it might be applied to several species of *Geranium*."

The critical species of Dr. James's collection were submitted to Dr. John Torrey for examination and publication, and the notable and new species were published in 1826, in the Annals of the Lyceum of New York, volume 11. On page 173 we have, "Geranium caespitosum James, in Long's Exped. ii. p. 3," and the description substantially as quoted above. Dr. Torrey remarks: "There are no specimens of this plant in the collection. Found on the sandstone ledges at the base of the Rocky Mountains." Dr. Torrey quotes from the American edition of Dr.

James's "Account," which was published in 1825, or two years later than the London edition. The name of the *Geranium* is changed from *G. intermedium* to *G. caespitosum*.

The basis of our present understanding of *G. caespitosum* James is Dr. Asa Gray's description in "Plantae Fendlerianae," p. 25. Dr. Gray was instrumental in sending out Professor Augustus Fendler with an army company, in 1846, to Santa Fe, New Mexico, and the collections on which the description is based were made by Fendler, in 1847, "on Santa Fe Creek, near irrigating ditches, at the foot of mountains; May to July; and six miles east of the Mora River: August." Of this *Geranium* Dr. Gray gives a clear and carefully made description and says: "Dr. Engelmann had indicated it as a new species; but I am so confident that it is the species noticed and imperfectly characterized by Dr. James that I venture to revive his name, which unless thus identified, must ever remain appended to the genus as a doubtful species, since no specimen of it exists in the collection made by him in Long's Expedition."

In 1897, fifty years after Professor Fendler's collection, Professor A. A. Heller and Mrs. Heller collected plants about Santa Fe, and along Santa Fe Creek collected a *Geranium*, which Professor Heller published in 1898 as *G. atropurpureum*,* and he made this new species to take the place of Dr. Gray's publication, saying that the *Geranium* which Dr. Gray published was not *G. caespitosum* James. In his article Professor Heller says: "All the evidence seems to indicate that the real *Gerauinm caespitosum* is the plant now known as *Geranium Fremontii*, at least so far as applies to the plant collected by Fremont. What Fendler's specimens from 'bottom lands of the Mora river' and Lieutenant Abert's from the 'Raton Mountains' [plants cited in the original description] may be, I do not know, but they are hardly the same as Fremont's specimens, and apparently different from *G. atropurpureum*." However, the type of *G. Fremontii* Torr., as published by Dr. Torrey in "Plantae Fendlerianae," page 26, was collected in the vicinity of Santa Fe by Professor Fendler. Of course it may not be identical in character with the plant collected by Fremont in the Black Hills, in 1842, as listed in the "Catalogue of Plants collected by Lieutenant

* Bull. Torrey Club **25**: 195. 1898.

Fremont in his Expedition to the Rocky Mountains." This plant was listed by Dr. Torrey in the catalogue as a "n. sp." and given the name *G. Fremontii*, but I do not know of any description of it. Professor Heller failed to note the exact locality where Dr. James collected *G. caespitosum*, though he quotes from Dr. James's description of the rocks and character of the country, and writes: "At this place, 'about the sandstone ledges,' is where he collected his *Geranium*, either in what is now the State of Nebraska, or at most, in extreme northeastern Colorado." Professor Heller also said that Dr. James did not go farther south than Pike's Peak, which, of course, is a mistake.

The recent makers of Rocky Mountain Floras differ in their treatment of the geraniums and in their disposition of *G. caespitosum*. Dr. Trelease* accepts Dr. Gray's identification of it with the Santa Fe plant and gives its range as "Arizona, New Mexico, and southward." Dr. Nelson† accepts Dr. Gray's conclusion and makes *G. atropurpureum* Heller a synonym. He gives its range as "Central Colorado but occasionally north to Wyoming and south to New Mexico." Dr. Rydberg‡ accepts *G. atropurpureum* Heller and for *G. caespitosum* James makes a description much like Dr. Gray's. He describes it as being found on "Plains, foot-hills, and the lower mountains: Colo.— Wyo.— Utah."

It is evident that the place to look for *Geranium caespitosum* James is the place where Dr. James collected it; that is, "about the sandstone ledges," where the Long Expedition camped from July 6 to July 9, 1820. This place is so definite and so restricted that one looking for it can not miss it. "Our camp," wrote Dr. James, "was immediately in front of the chasm, through which the Platte issues from the mountains." On account of the rocky and hilly nature of the country the place has not been cultivated, and is in much the same condition as it was in 1820. Among the ravines of the sedimentary rocks a *Geranium* grows abundantly and luxuriantly. It is *G. Fremontii* var. *Parryi* Engelm., more lately known as *G. Parryi* (Engelm.) Heller, and is the only *Geranium* found in the immediate vicinity. The reason why *G. Parryi* has not been associated with *G. caespito-*

* Syn. Fl. N. Am. 1: 359. 1897.
† Coulter & Nelson, New Man. Bot. Rocky Mt. 303. 1909.
‡ Fl. Rocky Mts. 533. 1917.

sum, probably, is that Dr. Gray's solution of the problem has been largely accepted, and that the type locality of *G. Parryi* is some distance from, and at a much higher altitude than, the place where *G. caespitosum* was collected. The type locality of the former is, "from the head waters of Clear Creek and the alpine ridges lying east of 'Middle Park,' Colorado Territory. C. C. Parry, coll., 1861." It is one of those plants whose range is from the foothills to the high mountains. The localities where it has been collected, as listed by Dr. Rydberg in his Flora of Colorado, include Boulder, Colorado Springs, Idaho Springs, Pike's Peak, and the head waters of Clear Creek.

There can be scarcely a doubt that the same *Geranium* has continued to grow "about the sandstone ledges" from the time when Dr. James collected it to the present time; and, granting that this is so, *G. atropurpureum* Heller is all right, but *G. caespitosum* or, since the law of priority should hold, *G. intermedium* James should take the place of *G. Parryi* (Engelm.) Heller, and the latter become a synonym.

WINDSOR, COLORADO

Abnormal elaters of Porella platyphylla

F. M. Andrews

(with plate 3)

In 1908 the writer* described and illustrated an archegonium of *Porella platyphylla* having two egg-cells, two ventral canal cells, and two rows of canal cells, therefore forming two complete axial rows instead of the usual one row. The elaters also were abnormal in that they were branched, in one case slightly and in another to a considerable extent.

In 1914 Manning† reported another case of an archegonium of *Porella platyphylla*, similar to the one above referred to. These abnormal archegonia coincide with the idea of Davis‡ concerning the origin of the archegonium. In *Mnium* also Coker§ found an archegonium containing two egg-cells, which, however, were superposed. More than one row of canal cells have been noted in the archegonium of *Mnium cuspidatum* by Holferty;|| Pace¶ has observed two adjacent archegonia in the prothallia of a fern with no wall between the egg-cells; and Lyon** has recorded other peculiarities in the archegonia of certain pteridophytes.

The present account deals with some unusual forms of the elaters in *Porella platyphylla*.†† While studying some material of this plant which was collected near Bloomington, Indiana, the writer observed that a few of the capsules contained a number of abnormal elaters, although nearly all of those examined were of the usual shape. Some of the abnormal elaters were kept for a time on the slide and not mounted permanently, so as to

* An abnormal *Porella platyphylla*. Bot. Gaz. **45**: 340. *f. 1–3*. 1908.

† Life history of *Porella platyphylla*. Bot. Gaz. **57**: 320–323. *pl. 15, 16*. 1914.

‡ The origin of the archegonium. Ann. Bot. **17**: 477–492. *f. 21, 22*. 1903.

§ On the occurrence of two egg cells in the archegonium of *Mnium*. Bot. Gaz. **35**: 137. *f. 2*. 1903.

|| The archegonium of *Mnium cuspidatum*. Bot. Gaz. **37**: 106–126. *pl. 5, 6*. 1904.

¶ Bot. Gaz. **50**: 52. 1910.

** Bot. Gaz. **37**: 282–285. 1904.

†† For a consideration of *Porella platyphylla* and *P. platyphylloidea* see Müller in Rabenhorst's Kryptogamen-Flora **62**: 573, 581. 1915. Also Evans, Rhodora **18**: 74–85; 103–119. 1916.

ascertain their behavior when in dry or moist air. Many of the elaters branched, as was shown in my former account, but in the elaters here being considered the branching was more extensive. In one case an elater had sent out two branches from the sides, FIG. 1, so as to give rise to four prongs or divisions. In another case, FIG. 2, the original elater, A, had produced three branches, B, C and D, of different lengths; and the branch D had again produced a short branch E, so that the elater then had six branches.

Peculiarities were also observed in the number of spiral thickenings of the elaters. In a few of the elaters only one spiral was present, but generally there were two. Underwood* states that the number varies from two to three. FIG. 3 is given here in order to show how the spiral thickenings are often torn away from the wall of the elater by handling. Macvicar† states that the spiral bands vary in some species from two to four. In most of the elaters observed, from the specimens under consideration here, the number of spiral thickenings was two in the unbranched elaters. A good many of the unbranched elaters showed three spiral thickenings (FIG. 3), which extended the entire length of the elater. In many cases they extended only part way from the center. In quite a number of instances the elater possessed four full length spirals (FIG. 4), and several had five such thickenings (FIG. 5). A few others had six (FIG. 6), and one very short, more or less reniform, elater showed ten spiral thickenings (FIG. 7). The last elater was so short and thick as scarcely to resemble in shape the general form of ordinary elaters, and the numerous crossing bands were difficult to observe separately and to follow. As regards its shape the elater shown in FIG. 7 somewhat resembles the "*verrucosa*" form of elater described by Macvicar‡ for *Fossombronia caespitiformis*, which has from three to five spirals. As above mentioned under FIG. 3 and shown also in FIGS. 1 and 5 the spiral bands are more or less extensively torn away from the wall of the elater. The form of the simple or unbranched elaters is sometimes rather unusual, as in the case of FIG. 7;

* Gray, Man. Bot. Ed. 6, 708. 1889.
† Student's Handb. British Hep. 402. 1912.
‡ Op. cit. 83.

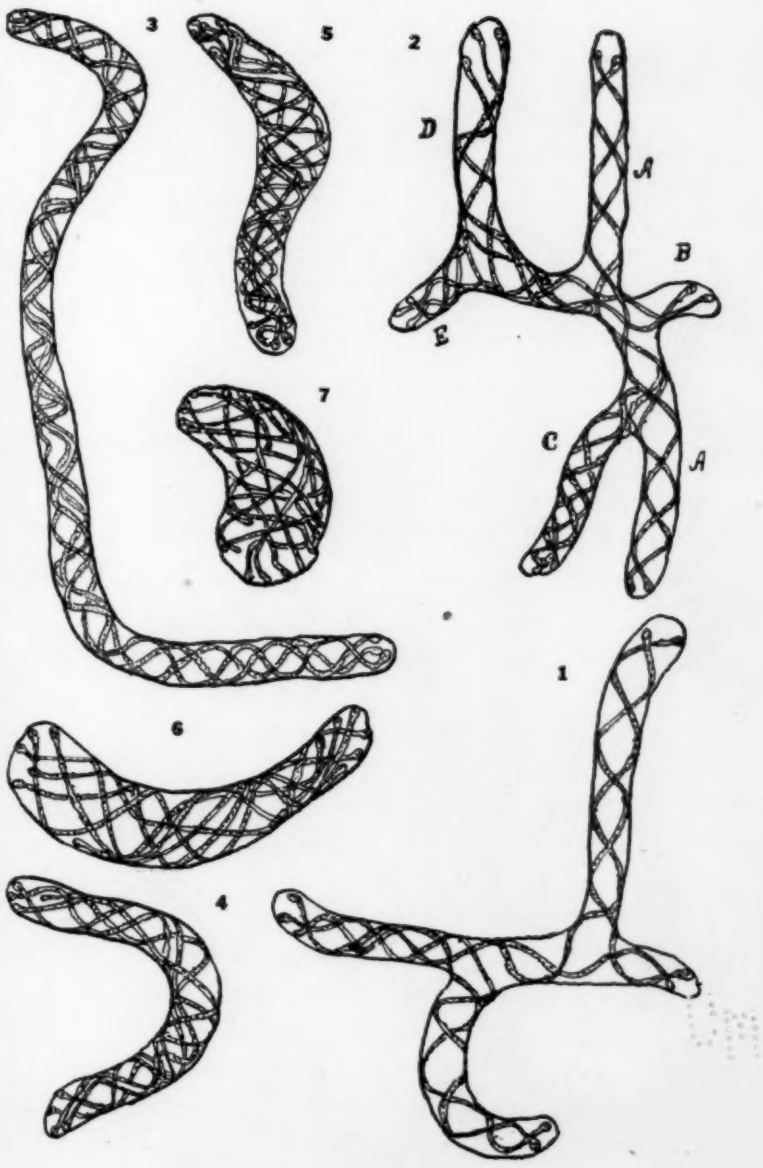
this holds true also for others, as in FIG. 6, and in some cases the elater approaches a more or less conical shape, the broad end of which is nearly flat. Even in the simple elaters the spiral thickenings do not always run the entire length of the elater. This is likewise true of some of the branched elaters and can be noticed to a certain extent in the supernumerary spiraled elaters shown in FIGS. 5 and 6. In the branched elaters shown in FIGS. 1 and 2, some of the branches show two spiral thickenings while others show three. The elaters of *Targionia hypophylla* frequently branch; in the example figured by Müller* two spirals are shown in one prong and three in another. The short elaters with supernumerary spirals evidenced a less active movement when placed in dry and moist air alternately than the longer and more slender elaters.

*Rabenhorst's Kryptogamen-Flora 6: 231. *f. 146.* 1907.

Explanation of plate 3

ABNORMAL ELATERS OP PORELLA PLATYPHYLLA

All figures × 300.



ANDREWS: ABNORMAL ELATERS OF PORELLA

INDEX TO AMERICAN BOTANICAL LITERATURE

1921–1922

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to foresty, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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